

Activity for Space Weather Research and Operation in NICT

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National Institute of Information and Communications Technology (NICT) has a long history to provide space weather (SWx) information service operationally since 1988 as an original member of ISES (International Space Environment Service). The importance of space weather information increases with development of Information and Communication Technology. The International Civil Aviation Organization (ICAO) has been discussing the use of SWx for civil aviation. Here we introduce NICT's activity for SWx research and operation.

1. Recent Accomplishments

- Operational observation
 - Ionosphere

Routine ionosonde observations in 15-minute intervals at Wakkanai (Sarobetsu), Kokubunji, Yamagawa, and Okinawa (Ogimi) stations have been continued. We have been replacing all the ionosondes from 10C to Vertical Incidence Pulsed Ionospheric Radar 2 (VIPIR2). The hardware

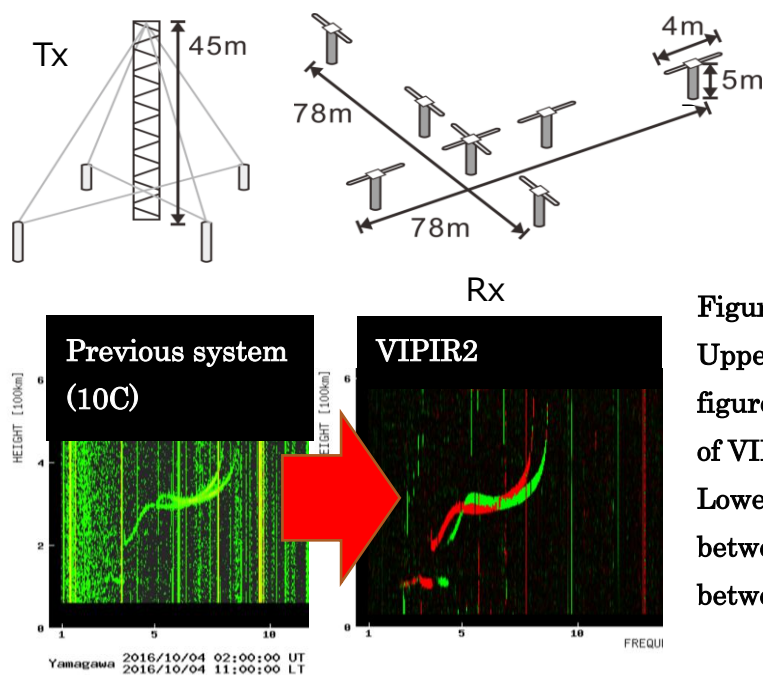


Figure 1
Upper: the schematic figure of the configuration of VIPIR 2 Tx and Rx.
Lower: comparison between the ionograms between 10C and VIPIR2

of VIPIR2 has already been installed at the four stations and test observations have started in 2016. Routine observations using VIPIR2 will start in 2017. In addition to ionosonde, we have observed two-dimensional TEC over Japan using a dense GNSS network, GEONET. Real-time TEC maps with less than 5-min delay are now available on the website.

➤ Solar observation

Routine observation of solar radio bursts started in August 2016 at Yamagawa radio observation facility, NICT. The observed frequency is in the range of 70 - 9000 MHz which is one of the widest frequency ranges in the world. Full resolution of time and frequency are 8 milliseconds, and 31.25 kHz (MHz range) and 1 MHz (GHz range), respectively. Right and left handed circular polarizations are obtained. Low resolution data (1 second and 1 MHz) will be distributed in FITS format in 2017.



Figure 2 Radome of Yamagawa solar radio observatory

➤ Satellite data reception / processing (DSCOVR / STEREO / Himawari)

NICT has been contributing real-time solar wind data reception network since 1997. From July 27, 2016, we start receiving real-time data from DSCOVR, the new operational solar wind monitoring satellite. We have been receiving real-time solar image and solar wind data from STEREO since 2007. Real-time Himawari / Space Environment Data Acquisition Monitor (SEDA) data is provided by Japan Meteorological Agency. High energy electrons and protons at Japanese meridian of geostationary orbit (GEO) are monitored by SEDA onboard Himawari-8 (since Nov. 03, 2014) and -9 (since Dec. 20, 2016). From October 2016, we have been operating online database of Himawari/SEDA (<http://seg-web.nict.go.jp/himawari-seda/>). We are distributing real-time SEDA data to other RWCs on request basis.

● Research product

➤ SEALION

We have developed the Southeast Asia low-latitude ionospheric network (SEALION) to research severe equatorial ionospheric phenomena such

as plasma bubbles under the international collaboration. SEALION mainly consists of five FMCW ionosonde along the magnetic meridian of 100°E (Chiang Mai and Chumphon in Thailand, and Kototabang in Indonesia) and along the magnetic equator (Chumphon, Bac Lieu in Vietnam, and Cebu in Philippines). In 2016, we have started developing a new FMCW ionosonde system using a software defined radio (SDR) platform.