



Strategy of ionospheric research and operation in NICT

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National Institute of Information and Communications Technology (NICT) is the only organization in Japan to that provides operational services for space weather information. NICT is a member of International Space Environment Service (ISES) and a part of ICAO global space weather centers, which monitors and forecasts space weather 24/7.

It is important to monitor and forecast the ionosphere for the use of communications and broadcasting (especially in the HF band) and for GNSS applications. At the same time, however, it is difficult to forecast the ionosphere, and NICT have a strategy to improve this ionosphere forecasting technique. For operational observation of the ionosphere, NICT has four ionosondes in Japan and one in Antarctica, and their observation data is provided on a real-time basis by website. In addition, NICT has ionospheric observation network named “SEALION” in Southeast Asian region in cooperation with universities and research institutes in each country. One of the main objectives of SEALION is monitoring equatorial plasma bubbles (EPB), which can seriously affect GNSS use. A prototype of an EPB alert system for GNSS users is currently being developed based on observations with VHF radars, ionosondes, and GNSS receivers.

NICT has developed a whole atmosphere-ionosphere coupled model, “GAIA”. Currently, we are developing a data assimilation system based on GAIA with the aim of operational ionospheric forecasting after 2025, using as input data (1) meteorological reanalysis data, (2) ionospheric occultation data derived from COSMIC2/FORMOSAT7, (3) ground-based GNSS receiver and ionosonde network data, and (4) solar wind observation data.

NICT is also developing applications and information provision systems that can be easily understood and used by people with no general knowledge of space weather. HF-START is one of examples, which is a web application that allows users to visualize HF-band radio propagation based on the ionospheric condition derived using GNSS receiver networks or ionospheric models such as GAIA. In addition, as an information provision, we are also developing new alert types and criteria that are user-friendly, taking into account their social impact based on the report of “Study Group on Advanced Space Weather Forecasting” organized by the Ministry of Internal Affairs and Communications in 2022.