

S002-20

A 会場 : 11/26 AM2 (10:30-12:00)

11:25~11:40

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Impact of ionospheric activity on air navigation integrity and accuracy in ADS-B

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The Automatic Dependent Surveillance-Broadcast (ADS-B) is a surveillance technology primarily used by aircraft and airport vehicles. The ADS-B message includes a position derived from GNSS satellite positioning, barometric altitude, aircraft speed, and the aircraft's identity. It also broadcasts integrity and accuracy information known as the Navigation Integrity Category (NIC) and Navigation Accuracy Category - position (NACp). Typically, NIC and NACp values are greater than 7 and 8, respectively, indicating that the radius of containment around the aircraft (Rc) is less than 185.2 meters and the Estimated Position Uncertainty (EPU) is less than 30 meters. However, during periods of high geomagnetic activity, NIC and NACp occasionally degrade to values below 7 and 8.

Since 2020, the Electronic Navigation Research Institute (ENRI) has been recording ADS-B messages at locations including Iwanuma, Minami-Soma, Chofu, and Ishigaki. At Ishigaki, an All-sky airglow imager (ASI) and a GNSS receiver have been installed. The ASI enables the detection of plasma bubbles, which appear as regions of plasma density depletion, causing amplitude or phase fluctuations in GNSS signals known as scintillation. Strong scintillation can lead to the loss of lock on GNSS signals, resulting in the GNSS receiver losing the signal. The GNSS receiver used is the Septentrio PolaRx5S, which provides phase and amplitude scintillation indices with a 1-minute sampling rate. Therefore, the degradation of NIC and NACp due to ionospheric activity can be investigated on Ishigaki.

In this presentation, we will show cases of NIC and NACp degradation during periods of high geomagnetic activity, particularly in May 2024. We calculate the Ionospheric Pierce Point (IPP) of the GNSS satellite signals for the aircraft that broadcasted the degraded NIC and NACp, to compare the scintillation indices and the horizontal structure of the plasma bubble. Finally, we discuss the contribution of geomagnetic activity to the degradation of NIC and NACp.