S002-P11
ポスター 1 ：11/24　PM1/PM2 （13:15-18:15）

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Evaluation of electron density variation using PHITS and GAIA models during solar flares in May 2024

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High-frequency (HF) radio communication is an important method often used in disaster response and air traffic control because of its capability for long-distance communication using reflections in the ionosphere. However, a rapid increase in X-ray emissions due to solar flares causes a rapid increase in the electron density in the lower ionosphere, and often making HF radio unusable. In May 2024, more than 10 X-class flares occurred, causing various space weather phenomena, including global occurrences of communication failures known as HF radio shortwave fadeouts (SWFs). SWFs were recorded in Japan more than 10 times during this period. In order to know the occurrence of these SWFs and their magnitude, it is necessary to estimate the fluctuations in electron density in the ionosphere accurately.

In this study, we use the GAIA model (Jin et al., 2011) and PHITS code (Sato et al., 2024) to estimate the electron density variation during solar flare. The GAIA is one of the effective numerical simulation models for the whole global atmosphere, providing electron density variations throughout the ionosphere in solar flare emissions. However, it still does not account for photochemical reactions in the ionosphere below 100 km. Therefore, we use PHITS, which is a particle transport and collision simulation code using the Monte Carlo method, to reproduce electron density variations in the lower ionosphere due to flare X-ray emission, and then to compensate for the electron density in the lower ionosphere.

The occurrence and magnitude of SWF can be known from the minimum frequency in the ionogram (f_{min}). From the ionogram of the ionosonde operated by NICT, we found that a strong SWF occurred in Japan on 11 May 2024 from 1:00 to 3:00 (UT) associated with the X5.8 class flare. In particular, a blackout was recorded at the ionosonde in Kokubunji for about an hour starting at 1:20 (UT). In this presentation, we will report an assessment of the electron density variability on 11 May 2024 by comparing the electron density determined using the PHITS and GAIA models with data observed by ionosondes in Japan. Additionally, we also discuss the SWFs caused by other flares that occurred in May 2024.