

R010-18

Zoom meeting C : 11/4 PM1 (13:45-15:30)

14:00-14:15

Calculation of the ray paths and propagation times of HF radio waves in the simulator of HF-START project.

#Ryo Nakao¹⁾, Hiroyuki Nakata²⁾, Kornyanat Hozumi³⁾, Susumu Saito⁴⁾, Mamoru Ishii⁵⁾, Hiroyo Ohya²⁾

¹⁾Graduate school of Chiba Univ, ²⁾Grad. School of Eng., Chiba Univ., ³⁾NICT, ⁴⁾ENRI, MPAT, ⁵⁾NICT

To provide the information of nowcast of radio propagation, HF simulator Targeting for All user's Regional Telecommunications (HF-STRAT) was launched as a collaborative project with NICT, ENRI and Chiba University. In this project, propagation paths of HF radio waves are calculated by a ray-tracing calculation. Using the results of the ray-tracing calculation, we have determined whether HF radio wave travels between any two points. We have compared the differences of the propagation time determined by the ray-tracing calculation with the observation of the HF radio waves transmitted from Nagara transmitter, RadioNIKKEI (35.46 N, 140.20 E). HF receivers are located at Chiba University (Chiba, 35.62 N, 140.10 E), Sarobetu (Hokkaido, 45.16 N, 141.74 E), Yamagawa (Kagoshima, 31.20 N, 130.61 E), Ogimi (Okinawa, 26.68 N, 128.15 E). By comparing the propagation time between Chiba and the other receivers, it is found that there was a difference of the propagation time between the ray-tracing results and the observations. This is because it is assumed that ground waves are propagated from Nagara to Chiba. Considering the decay of wave intensity between Nagara and Chiba, we found that the decay of sky wave that is reflected by the ionosphere was almost comparable to that of ground wave. It is considered that the radio wave propagation between Nagara and Chiba is not ground wave but sky wave that is reflected by the ionosphere or both ground wave and sky wave signals are received simultaneously at Chiba. In addition, the comparison between observation of propagation time differences using distant receivers except Chiba and propagation times derived from ray-tracing calculation is in progress to validate results of the simulator. Propagation times derived from waveforms obtained at Yamagawa and Ogimi were compared with those derived by ray-tracing calculations so far. In the simulator, we also plan to provide users with options to choose three types of electron density models (IRI, GNSS tomography, GAIA). For these options, we calculated ray-paths using three electron density models in four seasons of 2018 and examined differences between the ray-tracing calculation results derived from each electron density model.