R005-21
A 会場 ： 11/27　AM2（11:05-12:35）
12:05〜12:20:00

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Fine scale structures of the Es layer revealed by an ultra-dense GNSS network

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The Sporadic E (Es) layer is an ionospheric layer which has very high density but is thin in altitude occurring in the E region. It has been well known that the Es layer is formed by the vertical shear of the neutral wind. However, the occurrence of the Es layer is still difficult to predict due to its "sporadic" nature.

Recent advancement in the numerical simulation of the Es layer with realistic background neutral wind fields helped understanding the characteristics of the Es layer occurrences. However, it is still insufficent for prediction of the Es layer occurrence, which is partly because the spatial resolution is limited. Therefore, observations of the Es layers are still important for monitoring the Es layer occurrences. It is also important to investigate the development of the Es layer with fine resolutions in space and time.

The global navigation satellite system (GNSS) receiver network is now widely used to monitor the Es layer. The rate of total electron content index (ROTI) is one of the effective quantities to detect the Es layer. We used the data obtained from the ultra-dense GNSS network operated by SoftBank. ROTI values derived from the GNSS data are mapped at an altitude of 100 km with 0.05x0.05 degrees in the latitude and longitude.

Around 04:00 GPST (approximately 13:00 in the local standard time), ROTI enhancements which are considered to represent the Es layer with fine and complex structures were observed around 38-45N and 138-142E. The Es layer changed its shape as it drifted northward at about 90 m/s. At 04:00 GPST, the Es layer had vortex-like structures with scale size of about 50 km. The Es layer also showed periodic structures with scale size of about 20 km. The Es layer changed its form into ripple-like structures, and then decayed away. The total duration of the event was about two hours. The spatial structures are similar to those obtained by numerical simulations of the Kelvin-Helmholtz instability, breaking of atmospheric gravity waves, and the Es layer formed as a result of these processes.

Thus, studying fine scale structures of the Es layer by dense GNSS networks is very useful to enhance our understandings of the mechanisms of the Es layer. Our future studies include the statistics of occurrences of different complex shapes, scale sizes of them, area of the Es layer, and its lifetime.