R005-21
B 会場 ：9/25　AM2 （10:45-12:30）
11:00〜11:15

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Tomographic imaging of sporadic E-layer by sounding rocket S-520-32 observation

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Sporadic-E (Es) layers is a thin and dense layer appearing from 90 to 120 km and have been studied over six decades. Previous studies presented that the horizontal structure of the Es layer is likely to play an important role for the generation of medium-scale traveling ionospheric disturbances (MSTIDs) due to E-F coupling via the earth's magnetic field lines.

The sounding rocket S-520-32, which aimed to observe irregularities associated with the Es layer and MSTIDs, was launched from Uchinoura Space Center (USC), JAXA (31.25 deg. N, 131.08 deg. E) at 23:20:00 JST (UT+9) on 11 August 2022. It transmitted the dual-band beacon signals (150 and 400 MHz) and received GNSS signals to separately observe the total electron content (TEC) in the E and F region during the flight. The rocket flew between the E and F-layer and reached an apogee of 270 km. It splashed into the sea around 23:28:43. During the rocket flight, the MSTIDs were seen in the TEC map derived from the GNSS receiver network around the rocket trajectory. The ionosonde in Yamagawa, Kagoshima 44 km away from USC detected the Es layer and the foEs and altitude of Es layer were approximately 4.2 MHz and 90 km.

We installed the beacon receivers at USC, Tarumizu (TRM) (31.49 deg. N, 130.70 deg. E), Kirishima (KRS) (31.73 deg. N 130.73 deg. E), and Satsumasendai (SND) (31.83 deg. N, 130.34 deg. E). These four sites almost aligned with the backward extension of the line of rocket trajectory. Thus, the tomography technique could be attempted in the line to estimate the spatial distribution of the Es layer.

The dual-band beacon signals were successfully received in all sites. The TEC values were derived from the phase difference of 150 and 400 MHz signals after removing the phase shift due to the rocket spin. The TEC observed at four sites showed a similar trend and drastically increased when the rocket reached 116 km. This indicated that the path between the receiver and the rocket crossed the Es layer. After that, the TEC values increased moderately until the rocket reached 200 km in descending interval. During the rocket went down below 200 km, the TEC values decreased and widely fluctuated, implying the horizontal structure of the Es layer.

We performed the tomography analysis with the TEC values observed at four sites. The Es layer was found to be located at 116 km in the tomography result, and its peak density was 6×10^{10} m^{-3}. The Es layer distributed around 100 km distance from the USC, but from 100 to 220 km, there was no single peak of electron density. The Es layer was found again around 220 to 300 km from the USC, but the altitude was lower by about 4 km and the peak density was smaller by 1-4$\times 10^{10}$ m^{-3} than the Es layer around 100 km from the USC.

In this presentation, we will show the observation results as well as the comparison of it with ionosonde and onboard instruments. Furthermore, we will compare the horizontal structure of the Es layer and the F-region structure to discuss the E-F coupling process.