

A study of coupling process between F and E-region field-aligned irregularities with the MU radar and portable VHF radar

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In order to reveal coupling processes of ionospheric E and F regions in the mid-latitude, we conducted campaign observation 'F and E Region Ionosphere Coupling Study' (FERIX) in the summer of 2004. During the campaign, we observed E-FAIs with Lower Thermosphere Profiler Radar (LTPR) from Sakata, Yamagata and F-FAIs with the MU radar. Two radars observed different altitude, but they were connected along the same geomagnetic field. We can determined spatial structure of E-FAIs from LTPR interferometry observations, and that of F-FAIs from multi-beam experiment with the MU radar.

Mapping the F-region FAI echoes to the altitude of the E-region, we found that FAI echoes in both regions appeared in the same area and move westward (or southwestward) with similar phase velocities. During the campaign, we could found 10 such cases that both FAIs were clearly coupled. While there were no F-FAI echoes from the MU radar, E-FAIs appeared close to the geomagnetic-perpendicular line at 110 km altitude. Once F-FAIs occurred, however, the shape of E-FAIs changed to smaller fractions, and moved in the same direction as F-FAIs. This infers that the polarization electric field induce in the F region could influence occurrence of the E-region FAIs. We also investigate ionospheric total electron content (TEC) data from the GPS receiver network to study spatial structure of the F region in larger area. In the presentation we discuss the relationship between FAIs and electric field of both regions in more detail.