Radar observation of coupling process between midlatitude ionospheric F-E regions: FERIX-2

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We have been studying ionospheric filed-aligned irregularities (FAI) in the midlatitude region by means of radar and rocket experiment.The E-region FAI (E-FAI) is assumed to be caused by the polarization electric field owing to the electron density distribution in sporadic E (Es) layers. In the F-region FAI (F-FAI), the agreement between F-FAI and TID (Traveling Ionosphere Disturbances) is observed, and FAIs are thought to be generated by the polarization electric field caused by the electron density inhomogeneity in TIDs. In the ionosphere, conductance parallel to the geomagnetic field is so high that such polarization electric fields are easily mapped along the field line for several hundred kilometers. Because of the characteristics, it had been expected that FAIs in the E- and F-regions are geomagnetically coupled.

FERIX (F- and E- Region Ionosphere Coupling Study) observation campaign was carried out in 2004. By the observations, E- and F- region FAI was found at the same time along the same geomagnetic field, and propagated to the west with similar speed. This was the first clear evidence of the interaction of FAIs in the both regions. However, important problem was left unsolved which region contribute to the generation of the electric fields. Number of the observations are also limited. Therefore we will conduct the similar experiment FERIX-2 again in May to September 2007. We observe F-FAI with the MU radar from Shigaraki, and locate LTPR at Sakata for E-FAI experiment. We also operate a bistatic receiving site at Maze, Niigata to expand observation region of the LTPR.Observations of Doppler velocity of the echoes from both Sakata and Maze would reveal two dimensional motion of the E-FAI.In addition, airglow imagers and GPS-TEC data will be used to measure time-spatial structures of TIDs.

In FERIX-2, we also introduce radar imaging as new observation technique with radars. In FERIX observation, only wide echo distribution was found for F-FAI from multi-beam experiment of the MU radar. This time, radar imaging would show us more detailed structure of the F-FAIs.The imaging technique is also applied to the LTPR data, too.In the presentation, we will show outline an current status of FERIX-2 experiment, and our results from radar imaging technique applied to the MU radar and the LTPR.