

Geomagnetic Conjugate Observations of Medium-Scale Traveling Ionospheric Disturbances with All-Sky Airglow Imagers

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We report simultaneous observations of Medium-Scale Traveling Ionospheric Disturbances (MSTIDs) with two all-sky airglow imagers at geomagnetic conjugate points in both hemispheres. A 630nm all-sky CCD imager at Shigaraki (34.9N, 136.1E; magnetic latitude 29.8N) in Japan detected MSTIDs as several band-like structures with a wavelength of 200 km on the night of June 1, 2003 during FRONT(F-region Radio and Optical measurement of Nighttime TID)-3 campaign period. The MSTID structures were elongated from northwest to southeast and propagated southwestward. During this MSTID event, MSTID whose structures were elongated from southwest to northeast was observed at the geomagnetic conjugate point, Renner Springs in Australia (18.3S, 133.8E; magnetic latitude 29.6S). The MSTID propagated northwestward at the almost same velocity as the MSTID observed at Shigaraki. To investigate magnetic conjugacy of the MSTID structures, the Renner Springs images were mapped to its magnetic conjugate points in the northern hemisphere using the IGRF2000 model. The mapped MSTID structures coincide closely with those in the Shigaraki images. The incoherent scatter observations of the MU radar revealed that the F layer altitudes are modulated by the MSTIDs and that the airglow variations observed with the all-sky imager are attributed to the altitude variations of the F layer. These results suggest that polarization electric field plays an important role in the generation of MSTIDs. The polarization electric field is generated by the spatial inhomogeneity of the conductivity and the background ionospheric current to keep the current continuity. Eastward (westward) component of the electric field pushes up (down) the plasma in the F region causing decrease (increase) in the 630-nm airglow intensity because the airglow intensity is proportional to the product of the electron and molecular oxygen densities. The electric field is transmitted to the conjugate F region in the opposite hemisphere and pushes up (down) the F region plasma causing decrease (increase) in the 630-nm airglow intensity.