Tomographic Observations of the Ionosphere Over Japan During Summer

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A chain of GNU radio beacon receivers (GRBR) has been installed recently at Shionomisaki (33.45°N, 135.8°E), Shigaraki (34.85°N, 136.1°E) and Fukui (36.06°N, 136°E) in Japan, which continuously track the Low Earth Orbiting Satellites (LEOS). The simultaneous line-of-sight relative Total Electron Content (TEC) data collected by the beacon receivers are used for tomographic reconstruction. The paper reports the results from the continuous tomographic observations of the ionosphere during July-August 2008, and compares the results with FORMOSAT3/COSMIC (F3/C) radio occultation measurements. The two observations agree fairly well, and bring out the main features of the low-mid latitude ionosphere: (1) The electron density enhancements observed at ~26-31°N geographic (~16-21°N magnetic) latitudes during daytime are related to the Equatorial Ionization Anomaly (EIA), and (2) the enhancements observed at night at latitudes poleward of ~35°N geographic latitudes are related to the Mid-latitude Summer nighttime Anomaly (MSNA). The nighttime MSNA feature is found to exist only at altitudes near and above the ionospheric peak (above about 275 km). A comparison of the altitude profiles of electron density during day and night, local time variations of ionospheric peak height and calculations of the effective neutral wind velocity suggest that the neutral wind could be the main driver of MSNA, revealing yet another evidence for the coupled ion-neutral dynamics over mid-latitudes.