

Observations of Ionospheric Irregularities with the Equatorial Atmosphere Radar

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In the geomagnetic equatorial region, plasma irregularities which are generated in the lower ionosphere and spread to the upper ionosphere have been observed, and they sometimes reach 1000 km altitude. With the MU radar in the mid-latitude region, the quasi-periodic (QP) echoes and the continuous echoes have been detected in the E-region as well as the spread F echoes in the F-region. Observations have also been done with satellites, sounding rockets and other back scatter radars. Most of those, however, have been done in the geomagnetic northern hemisphere. So we conducted observations of the ionospheric irregularities with the Equatorial Atmosphere Radar (EAR) which is a large Doppler radar located in West Sumatra in the Republic of Indonesia (100.32N, 0.2S). Location of the EAR is unique as the geomagnetic latitude is 10.6S. We conducted the observations from October 27 to November 8, 2001, when intense echoes from the E- and F-region irregularities were detected.

In the E-region, echoes were found continuously at around 90 km and 110 km altitudes at night. The former echoes had a few kilometer thickness and appeared almost throughout the nights. In contrast, the latter had 2-8 km thickness and appeared from about 22 (LT) until pre-sunrise period. Echoes similar to the QP echoes were occasionally found from 95 km to 140 km altitudes before midnight. In the F-region, echoes similar to the spread F echoes were found in the altitudes from 200 km to 600 km. Although most of the F-region echoes showed Doppler velocities of less than 60 m/s, it reached up to 240 m/s away from the radar in several cases. In the F-region, periodic variations of echo intensity in altitudes were found, which could be attributed to the Faraday rotation effect since antennas with a single polarization are used with the EAR.

We compared our results of the echo power and the mean Doppler velocity in the E-region with a previous work with the Piura VHF radar [Chau and Woodman, 2002]. We also compared our results of the morphology and the occurrence altitudes of the echoes in the F-region with results by Hysell and Burcham [2001] with the JULIA radar at Jicamarca.

Observations of ionospheric irregularities with the EAR are planned during this spring equinox. We will present the results of the observations.