SuperDARN observations of high-velocity E-region echoes from the eastward auroral electrojet

Roman A. Makarevich

Department of Physics, La Trobe University, Bundoora, Victoria 3086, Australia
Email: r.makarevich@latrobe.edu.au

A statistical analysis of short-range E-region echoes observed by the SuperDARN HF radars in the evening sector (16-22 MLT) over 3 years near the solar cycle peak is presented. Significant populations of the high-velocity (350-450 m/s) E-region echoes similar to the classical Type 1 echoes are observed by 4 zonally-looking SuperDARN radars at small magnetic L-shell angles. The spatial occurrence pattern of Type 1 echoes is investigated. It is shown that the latitudinal (slant range) extent of the region where Type 1 echoes occur increases as the L-shell angle decreases, which is interpreted as widening of the aspect angle instability cone with the flow angle decrease. The echoes with unusually high velocities (500-600 m/s) observed by the Syowa East HF radar are also investigated. These echoes are seen at all L-shell angles (15-75 deg) and their Doppler velocity increases with range and exhibits little variation with L-shell angle. There is strong evidence that these echoes are observed both inside and outside the modified two-stream instability cone and are likely to be secondary waves. The echoes occur at ranges 360-495 km when the strong low-velocity echoes (P > 30 dB, V < 200 m/s) are observed at ranges 225-360 km. The high-velocity auroral echoes appear to be similar to the vertically propagating Type 1 echoes from the equatorial electrojet and may be generated through the nonlinear three-wave resonance interaction process.