

Initial backscatter statistics from mid-latitude SuperDARN radar in Hokkaido

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A statistical study of the occurrence of ground and ionospheric backscatter within the field-of-view of the newly deployed SuperDARN Hokkaido HF radar (43.53N, 143.61E) during the first 1 year of operation has been carried out. Four dominant backscatter targets are identified from the statistics: (1) daytime far range (greater than 1500 km) ground backscatter, (2) ionospheric backscatter at the dawn and duskside subauroral latitudes, (3) nighttime near range (less than 1500 km) backscatter and (4) very intense near range (less than 600 km) echoes. The first backscatter echoes have already been observed by the SuperDARN radars in the high-latitudes. This type of backscatter often contains wave-like perturbations in the power of backscattered signals, which has been interpreted as a manifestation of medium-scale traveling ionospheric disturbances (MSTIDs) appearing in daytime. The second backscatters have also been investigated in the past observation of high-latitude SuperDARN radars, which are known as dusk scatter event (DUSE). Past studies associated occurrence of DUSE with the electron density gradient at the sunward edge of mid-latitude trough because directions of the density gradient and ambient electric field are favorable for the growth of gradient-drift instabilities. In the current statistics, however, we identify new backscatter feature which seems to appear on the equatorward edge of the mid-latitude trough although its occurrence is relatively weaker. This finding leads us to reconsider generation process of FAIs in the vicinity of the mid-latitude trough at the subauroral latitudes. The third backscatters occurred at near ranges during local night in winter and summer months. They often have a Doppler shift greater than 100 m/s, which suggests that they should not be categorized as a ground backscatter. They also show some wave-like disturbances in backscatter power and Doppler velocity which mostly propagate equatorward. These wave-like features sometimes contain systematic reversal of Doppler velocity. These characteristics suggest that these nighttime near range echoes are caused by the mid-latitude F region FAIs possibly generated in association with the nighttime MSTIDs, that have been previously observed by the MU radar at VHF frequency. Of course the Hokkaido radar is able to observe backscatter echoes from the high-latitude cusp and subauroral polarization stream (SAPS) at far ranges. However, they seem to be invisible in the current statistics because they are basically transient.