A Backscatter "Hole" Inside a Quiet-Time Auroral Oval as observed by SuperDARN Radars and DMSP Instruments

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This study is based on four quiet-time events when DMSP satellites and three SuperDARN HF radars (the Iceland West and East and Finland radars) monitored the late-morning-to-evening sector of the auroral oval. The latitude range of these observations includes the diffuse luminosity belt, the discrete auroral oval and the equatorward part of the polar cap area.

In two cases the discrete auroral oval was observed as a hole between two regions of mainly E-layer and F-layer HF backscatter. It can be seen even during 6-7 hours. Above the E-layer backscatter region the DMSP satellites recorded central plasma sheet (cps) precipitation with a characteristic electron energy of ~4.5 keV and the mean energy flux of 0.40-0.55 erg/cm2, while above the HF backscatter hole they recorded boundary plasma sheet (bps) precipitation with a weaker characteristic electron energy (~ 1 keV), but slightly larger mean energy flux (0.6-0.75 erg/cm2). During the whole period, the position of the HF backscatter hole was systematically outside of the cps-region and inside the bps-region as observed by the DMSP instruments, and also as suggested by a statistical oval model. The poleward side of the auroral oval and the equatorward edge of the polar cap were covered by the F-layer HF backscatter which co-located with weak and soft auroral precipitation. According to the DMI Greenland magnetometer data, a wide band of the eastward Hall current flow was decreased at the backscatter hole latitude as a consequence of the softer electron precipitation there. The simultaneous POLAR UVI auroral images do not exhibit a similar hole-matched decrease of luminosity, which is , probably, due to the energy flux-related nature of the UVI images.

In two other cases the hole between two sparser E- and F-region HF echo populations was not so clear. The energy flux cps/bps ratio (as well as partly the flux itself) was smaller here (cps/bps ~0.25) than in the two former cases (cps/bps ~0.7).