SuperDARN HF radarを用いた北半球subauroral領域における F層irregularity発生分布解析

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Irregularity occurrence rate distribution in the subauroral region observed by SuperDARN HF radars

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The HF radars of the Super Dual Auroral Radar Network (SuperDARN) provide the oppotunities of continuous monitoring of the high-latitude ionosphere in the northern and southern hemispheres. Backscattering occurs from HF rays that come in contact with decameter-scale irregularities. The gradient-drift instability is most often cited to account for the formation of these small-scale irregularities. It requires a gradient in plasma density and electric field perpendicular to the geomagnetic field. Because the occurrence of HF echoes depends on both the presence of irregularity and the existence of a suitable HF propagation channel, it is generally impossible to separate the irregularity occurrence and propagation factors in considering a statistical study of irregularity occurrence. However, scattering occurrence rate provides a lower bound on the rate of irregularity occurrence, and some idea of the physical sources of the irregularities can be gleaned from the analysis of scattering occurrence. Ruohoniemi and Greenwald[1997] have investigated the statistics of HF scattering occurrence in the auroral region using 5.5 years routine observation of SuperDARN Goose Bay radar. In their statistics, the highest occurrence rates were obtained on the nightside for quiet conditions and in the afternoon for disturbed. They concluded that the density gradient deduced from particle precipitation was most significant for considering the scattering occurrence in the auroral region, but the effects of photoionization and density depletion of mid-latitude trough were not clearly identified. In this study we sorted the data of all radars in the northern hemisphere into 1x3 bins in geographic coordinate for each month, and investigated the dependence of irregularity occurrence on the density gradient associated with photoionization and mid-latitude trough. The study period encompassed 40 months(1995 to 1998), and corresponds to the most recent period of solar cycle minimum. As a result, we found a peak of occurrence rate on the dusk sector of the subauroral region near the terminator for quiet condition. In the disturbed case, occurrence rate peaks on the subauroral region around 16LT meridian. This result suggests that density gradients associated with terminator and mid-latitude trough mainly contribute to the irregularity occurrence in the subauroral region, and the effect of particle precipitation is less important in this region.
In presentation, we will show the Kp,Dst and IMF Bz dependence of the occurrence rate, and discuss the factors that influence it.