国際極年中に EISCAT スバールバルレーダーで観測された高強度のプラズマライン

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Strongly enhanced plasma lines observed by the EISCAT Svalbard Radar during the International Polar Year

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The plasma line (PL) is one of the signatures in the incoherent scatter radar spectrum and appears at frequencies up- and downshifted from the transmitted signal by a few MHz. These frequency shifts respectively correspond to the frequencies of the downand up-going scattering Langmuir waves plus the Doppler shift caused by the bulk motion of the electron gas. Although intensity of the PL is sometimes below noise level, it is occasionally enhanced and detectable in the presence of certain nonthermal features of the electron distribution function, such as local or magnetic conjugate photoelectrons and aurorally generated suprathermal (secondary) electrons. Especially during auroral activities, PL frequency and power may drastically change both with altitude and with time as reported from several case studies [e.g., Wickwar, 1978; Valladares et al., 1998; Kirkwood et al., 1995]. In companions paper [Ivchenko et al., submitted to Ann. Geophys.], data from the European Incoherent Scatter (EISCAT) Svalbard Radar (ESR) during the International Polar Year (IPY, from March 2007 to February 2008) are analyzed for statistical occurrence of enhanced PL. In this study, we use the same data set but focus on strongly enhanced plasma lines (sPL) with intensity higher than 1000 K. Occurrence peak of sPL is found near 4 UT and 14 UT (˜7 MLT and ˜17 MLT), while occurrence frequency of enhanced PL becomes higher when photo-electrons caused by the Sun's EUV radiation are present. While occurrence frequency of enhanced PL is highest in summer (May-Jun) and lowest in winter (Nov-Jan), occurrence frequency of sPL is higher in spring (Feb-Apr) than in other seasons. Occurrence of sPL is mostly below about 180 km altitude, whereas enhanced PL appears over the measured altitude range up to 278 km. Occurrence of sPL shows clear Kp dependence through the year: higher occurrence frequency during higher Kp values. Both up- and down-shifted sPL were usually observed near both edges of the observed frequency range until November 2007 (˜3.2 and 4.8 MHz; the latter should be aliasing) and near a center of the frequency range after December 2007 (˜3.2 MHz). This frequency convergence at ~3.2 MHz may be attributed to 2-4 eV dip in the electron distribution function caused by excitation of vibration levels in N2 [Nilsson et al, 1997], which results in low Landau damping and strong enhancement of Langmuir waves.

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