Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

PEM007-P01 Room:Convention Hall Time:May 27 15:00-16:15

Wave-particle interaction between whistler chorus and high-energy electrons: GEMSIS-RB Wave simulation

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Scattering process of high energy electrons by whistler chorus in the dipole field is studied to understand electron microbursts associated with whistler chorus by using GEMSIS-RB Wave code. Whistlers are assumed to propagate parallel to the magnetic field, and typical whistler chorus parameters, such as wave frequency, frequency drift rate, and wave amplitude, are assumed based on the spacecraft observations. By using the observed parameters, the GEMSIS-RB Wave code calculates the wave-particle interactions between whistler chorus and the high-energy electrons bouncing along the dipole magnetic field. The code can calculate the precipitation loss of energetic electrons during a few days, considering the micro wave-particle interactions with a few msec. This study focuses on the high energy electron precipitation loss associated with the scattering by whistler chorus with realistic parameters, and applies to understand a physics of high energy electron microburst.

Keywords: radiation belt, whistler chorus, wave-particle interaction

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PEM007-P02 Room:Convention Hall Time:May 27 15:00-16:15

Interactions between Oblique Whistler-Mode Waves and Energetic Electrons in the Earth's Radiation Belt

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We analyze the mechanisms of interactions between oblique whistler-mode waves and energetic electrons in the Earth's radiation belt. By the dispersion relation of whistler-mode wave, we calculate the refractive index in relation to propagation angle. We find that higher propagation angle makes the refractive index larger. Taking into account the dispersion relation, we perform the test particle simulations of energetic electrons interacting with oblique whistler-mode chorus. The source particles are assumed to be evenly distributed in gyro-phase. We calculate the trajectories of all electrons and energy exchanges, changing initial parallel velocity. The exponential terms appeared due to oblique propagation, in which include trigonometric function are calculated by using Bessel functions. We analyze energy changes and magnetic moment changes of electrons in case of Landau resonance and cyclotron resonance.

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PEM007-P03 Room:Convention Hall Time:May 27 15:00-16:15

Dayside chorus waves under quiet solar wind conditions: PENGUIn/AGO and THEMIS conjugate observations

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We study simultaneous observations of chorus waves in the magnetosphere and VLF waves in Antarctica on the dayside at high L-shells (L>7) under quiet solar wind conditions, using in-situ observations by THEMIS and ground-based VLF observations at automatic geophysical observatories (AGO) in Antarctica in the PENGUIn project. The scientific goal of this research is to identify where in magnetic latitude (MLAT), magnetic local time (MLT), and radial distance (or L-value) quiet-time dayside chorus waves can be preferably generated.

On 26 July 2008, the VLF receiver at the AGO P2 station (AP2: MLAT = -76.6 deg.) detected the intensification of VLF signals at the frequency range of 0.5-1.0 kHz between ˜1400 and ˜1700 UT. At the AGO P3 station (AP3: MLAT = -83.63 deg.), VLF signals increased at the 0.5?1.0 kHz frequency range between ˜1400 and ˜1800 UT; the increase rate was smaller than at AP2. The fluxgate magnetometer data confirmed that AP2 and AP3 were equatorward of the open-closed boundary.

During these intervals, THEMIS A, D, and E traveled in an outbound path at L = 7-10 and MLT = 11.5?13h. Both THEMIS A and D were magnetically conjugated to AP2 between ˜1600 and ˜1700 UT and to AP3 between ˜1430 and ˜1530 UT. THEMIS E was conjugated to AP2 between ˜1530 and ˜1630 UT. THEMIS A registered wave intensification at the frequency of 0.3 to 0.4 fce between ˜1330 and ˜1600 UT, where fce is the local electron gyrofrequency. THEMIS A wave burst data available during two intervals at ˜14UT confirm that the waves were circularly right-handed polarized. Filter bank data from THEMIS D and E show wave intensification in the 287-1240 Hz band at ˜1230 - ˜1530 UT and ˜1430 - ˜1630 UT, respectively.

Using the above-mentioned conjugate observations, we examine spatial distributions of chorus wave power and properties with respect to L and MLT. Our preliminary results imply that chorus wave power was more enhanced around noon than the dawn and dusk sides. We discuss what process(es) can explain such non-uniform wave power distributions under quiet solar wind conditions resulting in steady-state magnetospheric conditions, by simulating motion of energetic electrons in realistic 3D magnetic field and global convection electric field models. The simulation will also enable us to examine where in MLAT chorus waves are preferably generated.

Keywords: dayside chorus, conjugate observations, THEMIS, Antarctic research

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Rapid flux losses of the outer belt electrons due to the magnetopause shadowing effect: THEMIS observations

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Relativistic electrons of the outer radiation belt show dynamical variations associated with solar wind disturbances. These variations caused due to the complicated balance between acceleration and losses. One of the potential loss mechanisms is the magnetopause shadowing effect (MPS), according to which the electron drift orbits of the outer belt intersect the magnetopause, allowing electron escapes outside the magnetosphere. Therefore MPS has been proposed as possible loss process, but there have been only few observational studies to examine this process.

This study focuses on rapid electron loss of the outer radiation belt, by using GOES and THEMIS observations. We detect rapid electron loss at geosynchronous orbit, and separate these loss events using the movements of the outer edge of the outer radiation belt. Using the value of 20% of the peak flux as a proxy of the outer edge of the outer belt, we examined a relationship between the outer edge and the solar wind parameters as well as the magnetopause standoff distance. As a result, we find that the magnetopause standoff distance has a good correlation with the solar wind dynamic pressure, the IMF Bz, and the magnetopause standoff distance. Comparing with the GEMSIS-RB simulation, which includes only the MPS loss process, we can explain the observed losses are due to the MPS. In order to investigate the possibility of the outward radial diffusion after the MPS, we specifically studied the radial diffusion coefficient using the THEMIS data. The estimated radial diffusion coefficients have the same order as the empirical radial diffusion coefficients of Brautingam and Albert [2000], and are seems to be consistent with the outward radial diffusion hypothesis. The results are consistent with the scenario that the MPS causes the rapid depletion of the electron flux at the outer portion of the outer belt, while subsequent outward radial diffusion causes global loss of the outer belt.

Keywords: radiation belt, loss, inner magnetosphere, particle acceleration, solar wind - radiation belt interaction