R006-14
Zoom meeting B ：11/1 PM1 (13:45-15:30)
14:45〜15:00

Two types of storm-time Pc5 ULF waves excited in the Magnetosphere-Ionosphere coupled model

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Storm-time Pc5 ULF waves are electromagnetic pulsations (1.67-6.67 mHz), which can be generated by ring current ions associated with the injection from the magnetotail during substorms. The excitation mechanism and global distribution of ULF waves are keys to understand the dynamic variation of the outer radiation belt, since they can drive radial transport of radiation belt electrons [e.g. Elkington et al., 2003]. Theoretically, drift-bounce resonance has been considered to be a candidate excitation mechanism [Southwood, 1976]. Previous spacecraft observations suggest both drift resonance and drift-bounce resonance excitation of ULF waves [e.g. Dai et al., 2013; Oimatsu et al., 2018]. Recently, Yamakawa et al. [2020] could reproduce both the drift resonance and drift-bounce resonance excitation of ULF waves in the global drift-kinetic simulation. However the amplitude of the excited ULF waves is too small compared to spacecraft observations. One possible reason is the damping of field fluctuations at the ionospheric boundary in the model.

In order to improve the ionospheric boundary condition, we have made Magnetosphere-Ionosphere coupling between GEMSIS-RC [Amano et al., 2011] and GEMSIS-POT model [Nakamizo et al., 2012]. We use GEMSIS-RC model in the inner magnetosphere, in which 5D drift-kinetic equation for the PSD of ions and Maxwell equations are solved self-consistently. GEMSIS-POT is a 2-D potential solver in the ionosphere. We use FAC from GEMSIS-RC as an input to GEMSIS-POT for the Region 2 current. The resultant electric field potential is then used as the ionospheric boundary condition of GEMSIS-RC. The coupled model enables us to simulate ion injection from the plasma sheet into the inner magnetosphere.

Simulation results have shown the excitation of two types of Pc5 ULF waves. First, we find the drift resonance excitation of Pc5 waves (P1 waves) in the dayside. They are driven by the positive energy gradient of the PSD of ions with the energy of 50-120 keV. Second, Pc5 waves excited associated with the drift-bounce resonance (P2 waves) are seen in the duskside. They are driven by the inward gradient of the PSD of ions with the energy of 70-90 keV. We find that power spectra and wave frequency of P2 waves are enhanced if we increase the intensity of Region 1 FAC, which is not true for P1 waves. We will also report on what determines the wave frequency and azimuthal wave number of ULF waves and the effects of Region 2 FAC related electric field on the excitation of ULF waves.