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09:15-09:30

Study of internally driven ULF waves by ring current ions based on the Magnetosphere-Ionosphere coupled model

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Internally driven ULF waves are electromagnetic fluctuations in the inner magnetosphere, and 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 dynamic variation of the outer radiation belt, since ULF waves in the Pc5 range (1.67-6.67 mHz) are considered to contribute to the radial diffusion of radiation belt electrons [e.g. Elkington et al., 2003]. Promising candidates of excitation mechanism of internally driven ULF waves is drift-bounce resonance [Southwood, 1976]. Although previous spacecraft observations suggest the resonant excitation [e.g., Dai et al., 2013], there are other possibilities such as periodic pressure inhomogeneity formed by time-dependent injections. Recently, by using a global drift kinetic model (GEMSIS-RC), Yamakawa et al. [2019] confirmed the drift resonance excitation of storm-time Pc5 waves under the initial PSD with north-south symmetry. Also, Yamakawa et al. [submitted, 2020] reproduced the drift-bounce resonance excitation of Pc3 waves by including the asymmetry in pitch angle direction of the initial PSD. However, GEMSIS-RC model does not contain some important physical processes such as the feedback from the ionosphere and the dynamics of cold particles. In order to discuss the excitation of ULF waves more quantitatively, we will need to include these processes.
In order to simulate magnetosphere-ionosphere coupling, we use GEMSIS-RC model [Amano et al., 2011] for the inner magnetosphere and GEMSIS-POT model [Nakamizo et al., 2012] for the ionosphere. GEMSIS-RC solves 5-D drift-kinetic equation for PSD of ring current ions and Maxwell equations are solved self-consistently under the assumption that the first adiabatic invariant is conserved. GEMSIS-POT is a thin-shell model, which solves a 2-D ionospheric electric potential, and this model can include both Region 1 and Region 2 field aligned current. Since GEMSIS-RC model is capable of reproducing the Region 2 current, we use FAC from GEMSIS-RC as an input to GEMSIS-POT for the Region 2 current. In addition, the Region 1 current is exerted based on empirical models. The resultant electric field potential is then used as inner boundary condition of GEMSIS-RC. The coupled model enables us to simulate the ion injection from the plasma sheet into the inner magnetosphere. We will report on the details of effects of the M-I coupling on the excitation of ULF waves.
References:
Amano et al., J. Geophys. Res., vol.116, No.A2, 216, 2011.
Dai et al., Geophys. Res. Lett., vol.40, No.16, 4127-4132, 2013.
Elkington et al., J. Geophys. Res., vol.108, No.A3, 1116, 2003.
Nakamizo et al., J. Geophys. Res., vol.117, A09231, 2012.
Southwood, J. Geophys. Res., vol.81, No.19, 3340-3348, 1976.
Yamakawa et al., Geophys. Res. Lett., vol.46, No.4, 1911-1918, 2019.
Yamakawa et al., J. Geophys. Res., submitted, 2020.