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Simulation study on the evolution and propagation of whistler waves during storm time

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In the inner magnetosphere, plasma waves play an essential role for cross-energy coupling processes of different plasma/particle populations via wave-particle interactions. In order to understand the temporal-spatial variation of whistler mode waves in the inner magnetosphere, we simulate the evolution of the electron distribution function and the linear growth rate due to the anisotropies with the RAM electron code [Jordanova and Miyoshi, 2005]. Since the linear growth rate depends on the ratio of the plasma frequency to the gyro-frequency, the intense whistler mode emissions are observed near the plasmapause. In fact, the simulation results for a magnetically active period indicate that whistler mode waves are generated from post-midnight to the dawn-side outside the plasmapause. On the other hand, we do not observe significant wave excitation inside the plasmapause, because hot electrons from the plasma sheet do not access inside the plasmapause. The three-dimensional ray-tracing study indicates that the whistler waves excited outside the plasmapause can propagate into the plasmasphere through multiple reflections at LHR resonance point. Therefore, one of the origin of plasmaspheric hiss is whistler mode waves generated outside the plasmasphere, as suggested by Bortnik et al.[2008].

Keywords: inner magnetosphere, whistler mode waves, simulation, cross-energy coupling