Energetic electron precipitation via oblique whistler mode chorus emissions in the outer radiation belt

Yikai Hsieh and Yoshiharu Omura
Kyoto University, Research Institute for Sustainable Humanosphere, Japan (ayikaih@gmail.com)

Whistler mode chorus emissions in the Earth’s magnetosphere cause energetic electron precipitation and the associated pulsating aurora. First-order cyclotron resonance in parallel whistler mode wave-particle interactions is the main mechanism of the precipitation. Not only cyclotron resonance but also Landau resonance and higher-order cyclotron resonances occur in the oblique whistler mode wave-particle interactions. Especially, electrons can be accelerated and scattered to lower equatorial pitch angles rapidly via Landau resonance. We apply test particle simulation and the Green’s function method to check the energetic electron precipitation caused by oblique chorus emissions. We simulate the wave-particle interactions around L=4.5 for electron ranges from 10 keV to a few MeV. We further compare the precipitation fluxes between parallel and oblique chorus emissions. Our simulation result reveals that oblique chorus emissions lead to more electron precipitation than parallel chorus emissions. At kinetic energy $E < 100$ keV, the electron precipitation ratio (oblique case/parallel case) is about 1.3. At $100$ keV $< E < 0.5$ MeV, the ratio is greater than 2. At $E > 0.5$ MeV, the ratio is greater than 2 orders. Multiple resonances effect in the oblique whistler mode wave-particle interactions is the reason for the greater precipitation.