3rd URSI AT-AP-RASC, Gran Canaria, 29 May – 3 June 2022

The Effect of Chorus Waves on the Dynamic Evolution of Radiation Belt Electrons

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1 Extended Abstract

Chorus waves are suggested to play an important role in the dynamic evolution of radiation belt electrons [1, 2, 3]. To quantify the effect of chorus waves, we developed analytical models for chorus waves using more than 5 years of Van Allen Probe data [4]. These models depended on L, MLT, magnetic latitude and geomagnetic condition. However, due to the limitation of the Van Allen Probes orbit, these models are confined to magnetic latitude 20°. Previous studies [5, 6] suggested that chorus waves at higher latitudes are capable of producing very fast losses of the relativistic electrons on the scale of one day. Referring to observations from Cluster satellites [7], we extend our chorus wave models to higher latitudes. By performing long-term simulations using the three-dimensional Versatile Electron Radiation Belt code, we find that the variability of chorus waves at high latitudes is critical for modelling of MeV electrons. We show that, decrease in high-latitude chorus waves can tip the balance between acceleration and loss towards acceleration, or alternatively, the increase in high-latitude waves can result in a net loss of MeV electrons [8]. Variations in high-latitude chorus may account for some of the variability of MeV electrons. Based on these knowledge, we perform long-term simulations for the Van Allen Probe era and systematically validate our simulation results against Van Allen Probe observations. We also calculate and parameterize the lifetime of the electrons with an energy range from 1 keV to 2 MeV.

References

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