



Multiple roles of plasma waves in geospace: Arase observations

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Different types of plasma waves exist at a wide frequency range, from ULF to HF, in geospace. Geospace is often referred to as a "zoo of plasma waves," as it contains MHD waves in the low-frequency range, ion cyclotron waves, whistler mode waves, Z, LO, RX-free space mode waves, and several types of electrostatic waves. These waves play essential roles in the dynamical evolution of plasma and particles in geospace, including energetic particles in the radiation belts. The geospace exploration satellite, Arase (ERG), was launched in 2016 and began its primary mission at the end of March 2017 [Miyoshi et al., 2018]. The Arase satellite measures electric fields from DC to 10 MHz with three different receivers and magnetic fields from DC to 100 kHz with fluxgate and search coil magnetometers [Kasahara et al., 2018, Matsuoka et al., 2018]. These instruments have provided a new understanding of the multiple roles of plasma waves.

For example, Arase has identified the heating and acceleration of plasma and energetic electrons. It has also observed direct evidence of the scattering of energetic electrons by whistler mode waves, which causes auroral emissions in the ionosphere. Simultaneous relativistic electron precipitations cause significant ozone depression in the mesosphere, which is an example of cross-regional coupling through wave-particle interactions. The technique of measuring phase differences between the velocity vector of gyrating ions and the electric/magnetic field vectors of ion cyclotron waves and equatorial noise offers insight into the cross-energy coupling process among different plasma populations through wave-particle interactions.

In this presentation, we will highlight some observations from the Arase satellite and discuss future directions for study of plasma waves in geospace.

References

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