Project Details

ROSES ID: NNH11ZDA001N
Selection Year: 2012
Program Element: Focused Science Topic

Topic: Interaction Between the Magnetotail and the Inner Magnetosphere and its Impacts on the Radiation Belt Environment

Project Title:
Quantifying the effect of wave-driven electron precipitation on ionospheric conductivities

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Summary:
Magnetospheric plasma waves are known to be of critical importance in controlling the structure and dynamics of the Earth s radiation belts, and are implicated in a host of other phenomena. For example, in a recent series of papers it was shown that lower-band chorus was the dominant driver of the pulsating aurora, and that the combination of scattering by lower-band and upper-band chorus was responsible for producing the diffuse aurora. It is these two auroral phenomena that produce significant precipitation into, and modification of the upper atmosphere and ionosphere, precipitating electrons in the range of a few 10 s of keV in the case of pulsating aurora, and 0.1-10 keV in the case of the diffuse aurora. The diffuse aurora in particular is known for providing the main source of energy into the nightside upper atmosphere, though it is generally not visible to the naked eye.

The electron precipitation into the upper atmosphere leads directly to changes in the ionospheric conductivity which, in turn, controls the intensity and distribution of the global electric fields that drive convection and transport in the plasmasheet. The feedback loop is completed in that the transport of electrons in the plasmasheet determines the distribution of the excited magnetospheric plasma waves and their downstream effects on radiation belt acceleration and loss. In this way, there is an intimate interplay of the plasmasheet and the radiation belts, mediated by magnetospheric plasma waves and their modification of ionospheric conductivities.

In this proposal, we will use the RAM code to model the kinetic drift of energetic particles in the plasmasheet, and dynamically calculate the growth rates of Very Low Frequency (VLF) waves throughout the inner magnetosphere. By mapping growth rates to wave saturation amplitudes (as has been done in previous work) and calculating the electron precipitation rates, we will be able to assess the change in the ionospheric conductivity driven by the waves, and in turn modify the electric field in the inner magnetosphere.

The results of this work will be directly applicable to the goals outlined in several documents such as the Sun-Earth Connections Roadmap Report, and Heliophysics Roadmap, and is aimed at addressing Focused Science Topic (b) of the LWS TR&T program, entitled: Interaction between the magnetotail and the inner magnetosphere and the impact of that interaction on the radiation belt environment .

Publication References:

no references