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Frequency dependence of VLF chorus Poynting flux in the source region: THEMIS observations and a model

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Extended Abstract

We present the results of observations of VLF chorus emissions based on several events detected by THEMIS spacecraft within the chorus generation region. Using the THEMIS multicomponent wave data of parallel propagating chorus elements detected at some distance from the magnetic field minimum, we have found that the elements propagating equatorward had slightly but systematically higher frequencies and smaller amplitudes compared with simultaneously observed elements propagating away from the equator. The exponential growth rates of the elements propagating in both directions had close or equal values.

We propose an explanation of the observed feature on the basis of spatio-temporal evolution of the energetic electron distribution function in the course of VLF wave generation. The motion of electrons from the equator is accompanied by a decrease in their parallel velocity due to both, adiabatic mirror force and nonlinear wave-particle interaction, which causes an additional increase in the wave frequency of equatorward propagating chorus elements generated by such electrons. The elements propagating in the opposite direction, i.e., from the equator, are formed by electrons whose parallel velocities are larger due to the adiabatic mirror force. Correspondingly, such electrons generate waves with lower frequencies. We present the results of numerical simulations confirming the proposed mechanism.