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Coupling of electrons and inertial Alfven waves in the top-side ionosphere

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A one dimensional kinetic model is constructed to simulate the electron acceleration by inertial Alfven waves. The electrons are divided into cold and hot electrons and treated separately. Cold components are described by the fluid equation and hot ones by the Vlasov equation, both carrying field-aligned currents. Intense variation of Alfven speed has been introduced by inclusion of cold electrons. The model results show that the exponential decrease of the plasma density plays a key role, which leads to the sharp gradient of both Alfven velocity and electron inertial length. When Alfven waves encounter this sharp gradient at lower altitudes, the electrons accelerated by the waves become super-Alfvenic, and the width of burst structures becomes much wider than the electron inertial length. Consequently, the background electrons carry the oppositely field-aligned current due to plasma oscillation. It is demonstrated that the current carried by the electrons exceeding the wave front is balanced by the reverse current carried by background electrons. This mechanism can be used to reasonably explain observations of the electron bursts accompanied by little net field-aligned current. Furthermore, our simulation indicates that Alfven wave reflection is modified due to mirror force and wave particle interaction.

Keywords: inertial Alfven waves, super-Alfvenic, bursts