Modeling of Field-Aligned Electron Bursts by Alfvén waves

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A linear, one-dimensional gyrofluid code including electron inertia, electron pressure gradient, and finite ion gyroradius effects is applied to an inhomogeneous dayside auroral field line to determine the characteristics of propagating Alfvén waves with small perpendicular wavelengths. Test particles are then used to study the behavior of both magnetosheath and background ionospheric electrons under the influence of dispersive Alfvén waves. The test particle simulations verify results from previous studies such as reproducing electron energy and pitch-angle dispersions and, in doing so, validate the approach. The test particle simulations also show how particle trapping can lead to low-energy field-aligned electron bursts that are commonly observed in the dayside auroral region. We show that an increased mass density (significant O^+ density) in the acceleration region is an essential prerequisite to generate an electron burst. The primary effect of the O^+ is to decrease the phase speed of the Alfvén wave. Furthermore, the full gyro-kinetic effects of the O^+ act to produce a region in which the Alfvén speed profile is gradually slowing which significantly enhances electron trapping and keeps electrons trapped within the wave to lower altitudes. The trapping occurs if the parallel electric field is substantial enough (~0.2 mV/m) in the acceleration region to accelerate the background electrons. The gyrofluid code is currently being adapted for use in the simulation of Alfvén waves on the Jupiter-Io flux tube.