Parallel electric field structures in an auroral plasma

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ABSTRACT

Spiky parallel electric field structures have been studied in the auroral acceleration region consisting of electrons, protons and oxygen beams. Fluid equations have been used for the oxygen beam and the Boltzmann distributions are used for the protons and electrons. The coupled system of equations are reduced to a single nonlinear differential equation in the rest frame of the propagating wave for any direction of propagation with respect to the ambient magnetic field. The resulting nonlinear differential equations are solved numerically for different physical parameters considered in the system. Depending on the wave Mach number, proton and oxygen concentrations, and driving electric field, we find a range of solutions varying from sinusoidal to sawtooth and highly spiky wave forms for nearly parallel propagation. The results from the model are compared with FAST and Polar satellite observations.