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Two-dimensional PIC simulations of double layers in the upward current region of the aurora with quasi-dipole magnetic fields

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The results of applying two-dimensional particle-in-cell code to study the development of potential structures in the upward current region of an auroral plasma where quasi-dipole magnetic fields are applied is investigated. Within the resulting simulations a double layer (DL) forms in the auroral potential structure in the couterstreaming expansion area of cold plasma from bottom (ionospheric side) and hot plasma from top (magnetospheric side). A V-shaped potential structure is generated within the expanding plasmas with transversely non-uniform converging perpendicular electric field. Due to the inclusion of the more realistic magnetic fields in the auroal region (stronger in the ionospheric side) this V-shaped potential structure is very evident. We have observed the following dynamical evolutions: (1) recurring formation of the DL, (2) downward motion of the DL over the distance of thousands of Debye lengths, and (3) collapse of the existing double layer shortly after a new DL has formed near the top of the simulation region in the hot magmnetospheric plasma. The evolution of the DL and electron hole formation correlates well to data obtained through satellite observation.