Cross-Field Transport Due to Low-Frequency Oscillations in the Auroral Region: A Three-Dimensional Simulation*

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ABSTRACT. We have simulated the plasma transport processes in the nightside auroral region using our three-dimensional (3-D), multimoment, multifluid model. The model solves the continuity and momentum equations from 1500 km to 10 R_E and allows self-consistent treatment of the cross-field transport. It has been shown that the low-frequency D'Angelo instability, driven by the transverse inhomogeneity in the magnetic-field-aligned ion flow, was excited for the typical parameters in the auroral region. The instability generates cross-field transport, which significantly modifies the field-aligned flow. The effects of cross-field transport are discussed. In the nonlinear stage of the instability, V-shaped potential structures with magnitudes ~ 1 kV are formed. The simulation provides insight into the dynamical evolution of the D'Angelo instability in the ionosphere-magnetosphere coupling region, its effects on plasma transport processes, and formation of 3-D potential structures.

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